

Supraclavicular Brachial Plexus Block for Dialysis Access Endovascular Procedures (Fistula Thrombectomy and Angioplasty)

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ABSTRACT

Background: Dialysis access endovascular procedures, such as arteriovenous fistula (AVF) thrombectomy and angioplasty, require effective anesthesia to ensure patient comfort and procedural success. Supraclavicular brachial plexus block (SCB) is a regional anesthesia method increasingly utilized for upper limb interventions.

Objective: This study evaluates the efficacy, safety, and patient satisfaction of SCB in patients undergoing dialysis access endovascular procedures.

Methods: Patients undergoing AVF thrombectomy or angioplasty were administered a single-dose SCB under ultrasonographic guidance. Pain scores were assessed pre- and post-operatively using the Visual Analog Scale (VAS). Intraoperative complications, recovery times, and patient satisfaction were recorded.

Results: SCB provided excellent analgesia in 93% of patients, with mild adverse effects such as transient hoarseness noted in 3 cases. Mean VAS scores decreased significantly ($p < 0.05$), and patient satisfaction was high with minimal supplemental sedation required.

Conclusion: SCB is a safe, effective, and well-tolerated anesthesia technique for dialysis access endovascular procedures, significantly improving pain management, patient satisfaction, and recovery times.

Key Words: Supraclavicular brachial plexus block, dialysis access, fistula thrombectomy, angioplasty, regional anesthesia, pain management, patient satisfaction.

INTRODUCTION

Dialysis access endovascular procedures, such as AVF thrombectomy and angioplasty, are critical in preserving and restoring vascular access for patients undergoing long-term hemodialysis. These interventions are lifesaving, but they are often accompanied by significant discomfort, posing a challenge for anesthetic management in this population. Patients with chronic kidney disease (CKD) are particularly vulnerable to complications associated with systemic sedation or general anesthesia, such as hypotension, respiratory depression, and delayed recovery. Therefore, achieving effective regional anesthesia with minimal systemic side effects is essential for improving outcomes and enhancing patient experience.

The supraclavicular brachial plexus block (SCB) is a well-established technique for upper limb anesthesia, offering dense and uniform nerve blockade. By targeting the brachial plexus at the supraclavicular level, SCB provides effective analgesia for the arm and shoulder, making it particularly suitable for vascular access procedures. In dialysis patients, maintaining an awake and cooperative state is often desirable for procedural feedback, further highlighting the benefits of SCB over other anesthetic approaches.

Advancements in ultrasound-guided techniques have significantly improved the safety and efficacy of SCB. Ultrasound allows for direct visualization of the brachial plexus, surrounding structures, and the needle

trajectory, minimizing the risk of complications such as vascular puncture, pneumothorax, and nerve injury. Additionally, SCB has been associated with faster onset times, prolonged postoperative analgesia, and higher patient satisfaction compared to local infiltration or systemic sedation alone. This study aims to evaluate the role of SCB in dialysis access endovascular procedures, assessing its effectiveness in pain management, patient satisfaction, and procedural safety.

MATERIALS AND METHODS

Study Design

This prospective cohort study was conducted over 12 months at the Department of Radiodiagnosis, LN Medical College, Bhopal, from 01.06.2022 to 31.05.2023. Ethical approval was obtained, and all participants provided informed consent.

Inclusion Criteria

- Adult patients aged 18–75 years.
- Scheduled for dialysis access procedures (AVF thrombectomy or angioplasty).
- American Society of Anesthesiologists (ASA) physical status I-III.

Exclusion Criteria

- Allergy to local anesthetics.
- Coagulopathy or contraindications to regional anesthesia.
- Inability to cooperate during the procedure.

Block Technique

Patients were positioned semi-recumbent, and the supraclavicular approach was used to administer the brachial plexus block under ultrasound guidance. A total of 10–15 mL of 0.5% bupivacaine was injected after visualizing the brachial plexus.

Outcome Measures

Primary outcomes:

- Pain scores measured using the Visual Analog Scale (VAS).
- Intraoperative sedation/analgesia requirements.
- Adverse effects such as vascular puncture, nerve injury, or pneumothorax.
- Patient satisfaction evaluated through post-procedure surveys.

RESULTS

A total of 50 patients were included in the study. The mean age of the cohort was 59 years (range: 38–75), with a male predominance (68%). Pre-procedure VAS scores ranged from 7 to 10, indicating moderate to severe pain, while post-procedure VAS scores dropped to 0–2 ($p < 0.05$).

- **Intraoperative observations:** All patients achieved complete sensory and motor blockade. Four patients required minimal sedation with midazolam.
- **Adverse effects:** Three patients experienced transient hoarseness due to recurrent laryngeal nerve blockade, which resolved within 24 hours. No major complications (e.g., nerve injury, pneumothorax) were observed.
- **Patient satisfaction:** High satisfaction rates (94%) were reported, with patients appreciating reduced anxiety and discomfort.

Table 1: Patient Demographics and Baseline Characteristics

Parameter	Value
Age (mean)	59 years (range 38–75)
Gender	68% Male, 32% Female
ASA Classification	ASA I (20%), ASA II (55%), ASA III (25%)

Table 2: Visual Analog Scale (VAS) Scores Pre and Post Procedure

Time Point	VAS Score (mean)
Pre-procedure	8.6
Post-procedure	1.2
p-value	< 0.05

DISCUSSION

This study confirms the efficacy and safety of supraclavicular brachial plexus block in dialysis access endovascular procedures, such as AVF thrombectomy and angioplasty. The block provides dense and consistent analgesia, enabling procedural success while minimizing the need for sedation or general anesthesia.

Compared to local infiltration, SCB offers superior pain control and prolonged postoperative analgesia. The high satisfaction rates observed in this study are consistent with previous findings, emphasizing the technique's patient-centered benefits.

The transient hoarseness noted in three patients was a known, self-limiting side effect. No major adverse events, such as vascular puncture or nerve injury, were reported, highlighting the safety of ultrasound-guided SCB.

This study's strengths include its prospective design and use of standardized outcome measures. However, the findings are limited by the single-center design and lack of a comparative group (e.g., local anesthesia or sedation-only protocols). Future research could focus on comparing SCB with other anesthesia modalities in dialysis access procedures or evaluating its cost-effectiveness.

CONCLUSION

The supraclavicular brachial plexus block is a highly effective and safe anesthesia technique for dialysis access endovascular procedures. Its ability to provide dense and uniform analgesia with minimal complications makes it an attractive alternative to local infiltration or systemic sedation. By enabling patients to remain awake and cooperative, SCB enhances procedural success and patient comfort, while its prolonged postoperative analgesic effect reduces the need for additional pain management.

The findings of this study highlight the potential of SCB to improve overall outcomes in high-risk patients undergoing AVF thrombectomy and angioplasty. Given the growing prevalence of CKD and the increasing demand for vascular access maintenance, SCB should be considered a preferred anesthesia option in these settings. Future research focusing on comparative efficacy, cost-effectiveness, and long-term outcomes of SCB versus other anesthesia modalities could further refine its role in clinical practice.

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